

## **Efficacy of Wrist/Palm Warming as an EVA Countermeasure to Maintain Finger Comfort in Cold Conditions during EVA**

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### **Abstract**

**Introduction:** This study explored the effectiveness of local wrist/palm warming as a potential countermeasure for providing finger comfort during extended duration EVA. **Methods:** Six subjects (5 males and 1 female) were evaluated in a sagittally divided liquid cooling/warming garment (LCWG) with modified liquid cooling/warming (LCW) gloves in three different experimental conditions. Condition 1: Stage 1- no LCWG; chamber adaptation with LCW glove inlet water temperature 33°C; Stage 2-LCW glove inlet water temperature cooled to 8°C; Stage 3-LCW glove inlet water temperature warmed to 45°C; Condition 2: Stage 1-LCWG and LCW glove inlet water temperature 33°C; Stage 2-LCWG inlet temperature cooled to 31°C, LCW gloves, 8°C; Stage 3-LCWG inlet water temperature remains at 31°C, LCW glove inlet water temperature warmed to 45°C; Condition 3: Stage 1-LCWG and LCW gloves 33°C; Stage 2-LCWG inlet water temperature cooled to 28°C, LCW gloves, 8°C; Stage 3-LCWG remains at 28°C, LCW glove water temperature warmed to 45°C. **Results:** Wrist/palm area warming significantly increased finger temperature ( $T_{\text{finger}}$ ) and blood perfusion in Stage 3 compared to Stage 2. The LCW gloves were most effective in increasing Stage 3  $T_{\text{finger}}$  in Condition 1; and in increasing blood perfusion in Conditions 1 and 2 compared to Condition 3. Ratings of subjective perception of heat in the hands and overall body heat were higher at Stage 3 than Stage 2, with no significant differences across Conditions. **Conclusions:** Local wrist/palm warming was effective in increasing blood circulation to the distal extremities, suggesting the potential usefulness of this technique for increasing astronaut thermal comfort during EVA while decreasing power requirements. The LCW gloves were effective in heating the highly cooled fingers when the overall body was in a mild heat deficit.